



COURSE OUTLINE FALL 2020

| | Date | Initials |
|------------------------|-----------|----------|
| Prepared by Instructor | 20-Aug-20 | NRB |
| Approved by Head | 28-Aug-20 | MP |

1. Calendar Information

ENEL 353 **Digital Circuits**

Number systems and simple codes. Combinational logic: Boolean algebra, truth tables, minterms, maxterms, Karnaugh maps; gates, buffers, multiplexers and decoders; combinational circuit timing. Sequential circuits: latches and D flip flops; timing considerations; analysis and synthesis techniques; Mealy and Moore machine models; counters and registers. Introduction to memory arrays.

Course Hours: 3 units; H(3-1T-3/2)

Academic Credit: 3

Calendar Reference: <http://www.ucalgary.ca/pubs/calendar/current/electrical-engineering.html#7617>

2. Learning Outcomes

At the end of this course, you will be able to:

- 1 Express numbers in any radix, such as the decimal, binary, octal, and hexadecimal number systems, and to be able to represent negative numbers using 2's-complement format.
- 2 Apply Boolean algebra, and how to use to manipulate algebraic expressions, including canonical form and minimal-form sums-of-product (SOP) and products-of-sum (POS) expressions.
- 3 Use Karnaugh maps to obtain minimal-form SOP and POS expressions, and to explore multi-level combinational circuits using common logic gates.
- 4 Investigate practical design issues in digital circuits, including important timing characteristics.
- 5 Analyze and design combinational circuits using standard combinational-circuit modules, such as exclusive-OR functions, adders, subtractors, decoders, encoders, multiplexers, etc.
- 6 Analyze and design digital circuits using simple Programmable Logic Devices (PLDs), including Read-Only Memories (ROMs), and Programmable Logic Arrays (PLAs).
- 7 Understand the function of flip-flops, then analyze and design synchronous sequential logic circuits in which they are employed using state diagrams and tables, Mealy and Moore machine models.
- 8 Analyze and design important sequential-circuit modules, including various and important types of registers and counters.

3. Timetable

| Section | Day(s) of the Week | Time | Location |
|---------|--------------------|-------------|-----------|
| LEC 1 | MWF | 08:00-08:50 | WEB-BASED |
| LAB B01 | M | 14:00-16:50 | WEB-BASED |
| LAB B02 | M | 14:00-16:50 | WEB-BASED |
| LAB B03 | T | 17:00-19:50 | WEB-BASED |
| TUT T01 | T | 15:30-16:20 | WEB-BASED |
| LEC 2 | MWF | 11:00-11:50 | WEB-BASED |

| | | | |
|---------|-----|-------------|-----------|
| LAB B04 | W | 08:00-10:50 | WEB-BASED |
| LAB B05 | W | 08:00-10:50 | WEB-BASED |
| LAB B06 | T | 17:00-19:50 | WEB-BASED |
| TUT T02 | T | 15:30-16:20 | WEB-BASED |
| LAB B99 | TBA | TBA | WEB-BASED |

4. Course Instructors

Course Coordinator

| Section | First Name | Family Name | Phone | Office | Email |
|---------------------|------------|-------------|----------|---------|----------------------|
| L01/T01/B01/B02/B03 | Norm | Bartley | 220-5060 | ICT 306 | nbartley@ucalgary.ca |

Other Instructors

| Section | First Name | Family Name | Phone | Office | Email |
|---------------------|------------|-------------|----------|---------|--------------------|
| L02/T02/B04/B05/B06 | Steve | Norman | 220-8642 | ICT 411 | norman@ucalgary.ca |

5. Examinations

The following examinations will be held in this course:

1. **Midterm examination:** The midterm examination will be fully online, and will be designed to require less than 90 minutes to complete for most students. It will be scheduled in coordination with other Fall 2020 courses. Students will receive at least 24 hours to complete it. The exam will be posted on D2L at 3:00 PM Mountain Time on the day prior to the scheduled date, and will be due at 3:00 PM Mountain Time on the scheduled date. The precise format of the exam will be posted well in advance.

2. **Final examination:** To be scheduled by the Registrar's Office. The final examination will be fully online, and will be designed to require less than 3 hours to complete for most students. Students will receive 48 hours to complete it. The exam will be posted on D2L at 3:00 PM Mountain Time two days prior to the scheduled date, and will be due at 3:00 PM Mountain Time on the scheduled date. The precise format of the exam will be posted well in advance.

You will need access to a computer and internet, as well as an ability to scan and upload handwritten work. Microsoft Office Lens is recommended when using a smartphone or tablet to scan handwritten work.

Both the midterm and final exams are open-book and open-notes. You are permitted to access your own course notes, the textbook, a calculator, the course D2L site, and the internet. However, you are to respect academic integrity and not communicate about the exam with other students in the course or with any other person who could give you unfair help with the questions.

Note: The timetable for Registrar Scheduled exams can be found at the University's Enrolment Services website, <http://www.ucalgary.ca/registrar/>.

6. Use of Calculators in Examinations

There will be no restrictions on use of calculators or computers in exams and quizzes.

7. Final Grade Determination

The final grade in this course will be based on the following components:

| Component | Learning Outcome(s) Evaluated | Weight |
|---------------------|-------------------------------|--------|
| Assignments | 1-8 | 0% |
| Quizzes | 1-8 | 15% |
| Laboratory Work | 1-8 | 15% |
| Midterm Examination | 1-5 | 20% |
| Final Examination | 1-8 | 50% |

Total: 100%

Notes:

a) A grade of 40% or higher is required on the final exam to pass the course.

b) Conversion from a score out of 100 to a letter grade will be done using the conversion chart shown below. This grading scale can only be changed during the term if the grades will not be lowered.

| Letter Grade | Total Mark (T) |
|--------------|--------------------------|
| A+ | $T \geq 92.6\%$ |
| A | $87.9\% \leq T < 92.6\%$ |
| A- | $83.2\% \leq T < 87.9\%$ |
| B+ | $78.5\% \leq T < 83.2\%$ |
| B | $73.8\% \leq T < 78.5\%$ |
| B- | $69.1\% \leq T < 73.8\%$ |
| C+ | $64.4\% \leq T < 69.1\%$ |
| C | $59.7\% \leq T < 64.4\%$ |
| C- | $55.0\% \leq T < 59.7\%$ |
| D+ | $50.3\% \leq T < 55.0\%$ |
| D | $46.0\% \leq T < 50.3\%$ |
| F | $T < 46.0\%$ |

8. Textbook

The following textbook(s) is required for this course:

| | |
|---------------|--|
| Title | Digital Design and Computer Architecture |
| Author(s) | David M. Harris and Susan L. Harris |
| Edition, Year | Second Edition, 2013 |
| Publisher | Morgan Kaufmann (ISBN 978-0-12-394424-5) |

9. University of Calgary Policies and Supports

*SSE ADVISING AND POLICIES

All Schulich School of Engineering students have access to a D2L site titled “Engineering Student Centre”. Students have a responsibility to familiarize themselves with the policies available on this site.

*ACADEMIC MISCONDUCT

Academic Misconduct refers to student behavior which compromises proper assessment of a student’s academic activities and includes: cheating; fabrication; falsification; plagiarism; unauthorized assistance; failure to comply with an instructor’s expectations regarding conduct required of students completing academic assessments in their courses; and failure to comply with exam regulations applied by the Registrar.

For information on the Student Academic Misconduct Policy and Procedure please visit:

<https://ucalgary.ca/policies/files/policies/student-academic-misconduct-policy.pdf>

<https://ucalgary.ca/policies/files/policies/student-academic-misconduct-procedure.pdf>

Additional information is available on the Academic Integrity Website at <https://ucalgary.ca/student-services/student-success/learning/academic-integrity>.

*ACADEMIC ACCOMODATION

It is the student’s responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at <https://ucalgary.ca/student-services/access/prospective-students/academic-accommodations>.

Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) in accordance with the Procedure for Accommodations for Students with Disabilities (<https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities.pdf>). Students who require an accommodation in relation to their coursework based on a protected ground other than Disability should communicate this need in writing to their Instructor. SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/ .

*INSTRUCTOR INTELLECTUAL PROPERTY

Course materials created by instructors (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may NOT be reproduced, redistributed or copied without the explicit consent of the instructor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course at the same time may be allowed under fair dealing.

*FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY

Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary.

*COPYRIGHT LEGISLATION

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (<https://www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright-policy.pdf>) and requirements of the copyright act (<https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy <https://www.ucalgary.ca/pubs/calendar/current/k.html>.

*MEDIA RECORDING (if applicable)

Please refer to the following statement on media recording of students: https://elearn.ucalgary.ca/wp-content/uploads/2020/05/Media-Recording-in-Learning-Environments-OSP_FINAL.pdf

**Media recording for lesson capture*

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

**Media recording for self-assessment of teaching practices*

The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

**Media recording for the assessment of student learning*

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

SEXUAL VIOLENCE POLICY

The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at <https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>

*OTHER IMPORTANT INFORMATION

Please visit the Registrar's website at: <https://www.ucalgary.ca/registrar/registration/course-outlines> for additional important information on the following:

- Wellness and Mental Health Resources
- Student Success
- Student Ombuds Office
- Student Union (SU) Information
- Graduate Students' Association (GSA) Information

10. Statements Specific to Fall 2020

Course Format and Scheduling

The delivery of course content for ENEL 353 is classified as synchronous online learning. Synchronous learning takes place online during the registrar-scheduled class times. Although the course content will be available for viewing asynchronously, the instructors may use the scheduled periods as an opportunity for direct interaction with students.

Expectations for Attendance and Engagement in Online Sessions

Attendance is voluntary.

Guidelines for Completing and Submitting Coursework

Detailed instructions will be issued for submission of all lab work and online assessments.

11. Additional Course Information

Online quizzes.

There will be four quizzes throughout the Fall 2020 semester. These will be *timed assessments*. Each will be designed to be completed in less than 50 minutes for most students. In compliance with the guidelines in the revised 2020 Academic Calendar, students will receive an additional 25 minutes (50%) in each quiz. Each quiz will be made available on D2L for a full 24 hours; once the quiz is started within this period, the student will be timed at 75 minutes to complete it.

A schedule of quiz dates will be posted along with information on the precise format. You may use all the resources available to you for the midterm and final exams, subject to the same observance of academic integrity.

Laboratory information.

Students will be required to download and use digital circuit design software called Quartus Prime Lite 18.1, which is available for free from Intel Corporation's website. The software is for Windows-only computers, but works on Mac computers using a virtual machine. Detailed instructions on obtaining and installing the software will be posted on D2L.

Students may work individually or in pairs on the lab assignments. Detailed information will be posted on D2L along with a lab schedule.